

## A new population of X-ray transients in the Galactic Centre

Masaaki Sakano, Robert S. Warwick

*Dept. Phys. & Astron., Univ. Leicester, Leicester LE1 7RH, UK*

Anne Decourchelle

*CEA/DSM/DAPNIA, C.E. Saclay, 91191 Gif-sur-Yvette Cedex, France*

Q. Daniel Wang

*Dept. Astron., Univ. Massachusetts, Amherst, MA 01003, USA*

**Abstract.** A comparison of the *XMM-Newton* and *Chandra* Galactic Centre (GC) Surveys has revealed two faint X-ray transients with contrasting properties. The X-ray spectrum of XMM J174544–2913.0 shows a strong iron line with an equivalent width of  $\sim 2$  keV, whereas that of XMM J174457–2850.3 is characterised by a very hard continuum with photon index  $\sim 1.0$ . The X-ray flux of both sources varied by more than 2 orders of magnitude over a period of months with a peak X-ray luminosity of  $5 \times 10^{34} \text{ erg s}^{-1}$ . We discuss the nature of these peculiar sources.

### 1. Introduction

The Galactic Centre (GC) probably harbours a great number of transient X-ray sources. Past X-ray observations have revealed that the majority of the transient sources with the luminosity of  $L_X \geq 10^{35} \text{ erg s}^{-1}$  are low-mass X-ray binaries (LMXBs), containing a neutron star or black hole (eg., Sakano et al. 2002). Recent *Chandra* and *XMM-Newton* observations have lowered the detection threshold by 1–2 orders, thus providing access to potential new X-ray populations of sources with luminosity in the range  $L_X = 10^{32}–10^{34} \text{ erg s}^{-1}$ . Here we report two relatively faint X-ray transients, which exhibit unusual properties.

### 2. Results & Discussion

We have compared the *XMM-Newton*/EPIC and *Chandra*/ACIS Survey data obtained during the period between September 2000 and June 2002. We detected several transients within the  $0.3 \times 0.3 \text{ deg}^2$  field centred at  $(l, b) = (-0.^\circ 1, -0.^\circ 2)$ . Among them we detected XMM J174544–2913.0 and XMM J174457–2850.3 at the respective J2000 positions of  $(\text{RA}, \text{Dec}) = (17^{\text{h}} 45^{\text{m}} 44^{\text{s}}.38, -29^\circ 13' 0''.6)$  and  $(17^{\text{h}} 44^{\text{m}} 57^{\text{s}}.56, -28^\circ 50' 20''.7)$  coordinates with an error radius of  $8''$ .

XMM J174544–2913.0 was detected in September 2000 ( $L_X = 5 \times 10^{34} \text{ erg s}^{-1}$ ), but not in July or September 2001 with the lowest  $3\sigma$  upper limit for the 2–10

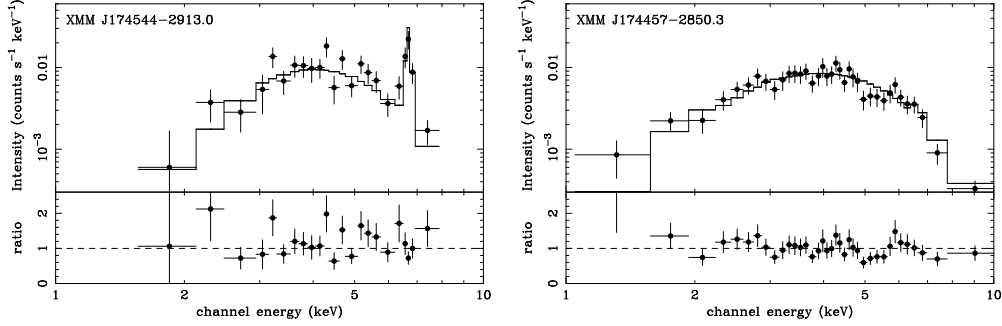


Figure 1. *XMM-Newton* MOS1 spectra of the two transient sources.

keV luminosity of  $3 \times 10^{32} \text{ erg s}^{-1}$ , assuming a distance of 8.0 kpc. As for XMM J174457–2850.3 we determined its 2–10 keV X-ray luminosity to be  $1 \times 10^{33}$ ,  $5 \times 10^{34}$ ,  $1 \times 10^{32} \text{ erg s}^{-1}$  in July 2001, September 2001 and May 2002 respectively. Furthermore, in the July 2001 observation the source flux declined by a factor of two or more in 10 ks.

Fig. 1 show the *XMM* spectra of the two sources when they were in the high state. XMM J174544–2913.0 was found to have an extremely strong iron line with a centre energy of  $6.68 \pm 0.02$  keV and an equivalent width (EW) of  $2.4^{+0.4}_{-0.5}$  keV, whereas XMM J174457–2850.3 exhibits a very hard continuum with photon index of  $0.98^{+0.33}_{-0.25}$  with a weak 6.7-keV line (EW=180±140 eV). Both the spectra are absorbed by a large column density:  $12.4 \pm 1.8$  and  $5.9 \pm 1.1 \times 10^{22} \text{ H cm}^{-2}$ , respectively. XMM J174457–2850.3 showed marginal evidence for softening of the spectrum from the high state ( $\Gamma \sim 1.0$ ) to low state ( $\sim 1.9$ ).

The strong iron line and transient nature of XMM J174544–2913.0 is quite similar to AX J1842.8–0423 (Terada et al. 1999). Thus, as suggested by Terada et al., it is likely to be a magnetised cataclysmic variable (CV) viewed from a pole-on inclination, which causes an apparently strong line at 6.7 keV from helium-like iron. However the large luminosity of over  $10^{34} \text{ erg s}^{-1}$  is quite unusual for CVs and some additional component, for example a jet, may contribute to the observed emission.

The nearly featureless and flat spectrum of XMM J174457–2850.3, as well as the existence of diffuse emission around the source, suggests that it may be a neutron star or black hole binary. The weak but significant iron line and the flat index point to this being a high mass X-ray binary (HMXB). However, both the quiescent luminosity of  $1 \times 10^{32} \text{ erg s}^{-1}$  and the peak observed luminosity of  $4 \times 10^{34} \text{ erg s}^{-1}$  are unusually low, suggesting the possibility of a wide eccentric orbit characteristic of many Be star X-ray binary systems.

## References

- Sakano, M. et al., 2002, *ApJS*, 138, 19  
 Terada, Y. et al., 1999, *PASJ*, 51, 39